

## **REMARKS**

Claims 1-21, 23-31 and 33-42 are pending in the application. Claims 1-19, 24, 26-31 and 39-42 have been previously withdrawn from consideration. Claims 20, 21, 23, 25 and 33-38 stand rejected to by the Examiner. The drawings have been accepted by the Office. The Examiner's objections and rejections are addressed below in substantially the same order as in the office action.

### **CLAIM REJECTIONS UNDER 35 U.S.C. § 112**

Claim 20 stand rejected under 35 U.S.C. § 112, first paragraph, because the Examiner contends that the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. Specifically, the Examiner contends that the “specification does not describe an embodiment of the shaped charge device that does not have a metal cap disposed upon the liner.”

In order to complete the record, Applicant requests the Examiner to identify what the Examiner contends is the level of ordinary skill in relevant art and the grounds underlying the applied level of skill.

In Applicants view, the metal cap shown is merely illustrative of a structure suitable for the purposes discussed in the specification. The technology and devices for forming perforating jets, Applicants believe, is sufficiently developed that one of ordinary skill in the art would instantly recognize the function performed by the metal cap and multitude of structures that would perform that function.

Claims 20, 21, 23, 25 and 33-38 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 21, the Examiner asks whether “[i]n claims 21, it is unclear whether the limitation, ‘filler material’ refers to the liner material pre-explosion or to the particulated portion of the jet post-explosion?” The specification explains as follows:

As noted, the filler material 30 is largely unconsolidated and is not compressed or sintered together. In the preferred embodiments, the density of the filler material 30 within the liner 24 is close to the formation density. As a practical matter, the density of the filler material is preferably below 2.7 g/cc, or the approximate density of solid aluminum. Uniformity in filling of the liner 24 with the filler material 30 is preferably achieved by vibration of the liner 24 during filling, depending upon the mass and particle size of the filler material 30.

Clearly, the claim, in light of the specification, intends that the density of the filler material be close to formation density. Thus, the only density that is expressly of concern is the density of the filler material impacting the formation.

Claim 20, 21, 23, 25 and 34-38 stand rejected as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. The Examiner contends that “[a]bsent the metal cap disposed upon the liner, it is unclear how, upon detonation of the shaped charge device, a jet is produced that comprises a forward portion and a substantially particulated portion of lower density than the forward portion?”

Applicant observes that the base claims recite a liner. As noted above, Applicant’s position is that those of ordinary skill in the art of ballistics can, based on the Applicant’s disclosure, readily devise a liner having the claimed features.

#### **CLAIM REJECTIONS UNDER 35 U.S.C. § 102**

Claims 20, 21, 23, 25 and 33-38 stand rejected under 35 U.S.C. § 102 (a & e) as being clearly anticipated by Liu (US 200310037692 Al). The Examiner contends that “It is inherent to Liu that the less dense portion of the jet formed from the aluminum powder is not formed as a completely solid non-particulated jet, but instead comprises a substantially particulated jet. Note that

the applicants' are not claiming a specific particulate size for the particles of the particulated potion of the jet.”

Applicant requests the Examiner to explain the technical justification for the assertion that Liu forms a “substantially particulated jet.” In the paragraphs cited by the Examiner, Liu expressly states that the aluminum powder is heated to a molten state:

[0137]...Liner 10 in the figure can be made of solid aluminum or compacted aluminum powder. The use of a variation in the material is also possible, such as an aluminum alloy in solid form or in compacted powder form, or a mixture of aluminum powder with other powder materials such as copper powder, tungsten powder or lead powder etc. In the present invention, liner 10 is designed to function dual purposes, to form a jet to penetrate a target and to project some **molten aluminum** into the target along a perforation created...

[0138] ...A big entrance hole makes it easier for the **molten aluminum** to be projected into the perforation and also easier for water to enter it. After the perforating is completed, it also makes it easier for the hydrocarbons to flow into the well...

[0139] ...Then the right liner density for the required charge performance can be found. For example, a mixture of 50% aluminum powder with 50% copper powder used to make a liner would have a density more than two times higher than that made with pure aluminum powder. This would significantly increase the charge penetration, but the amount of aluminum **in molten state** that can be projected into the perforation will be reduced, and the reactivity of the **molten aluminum** with water will be decreased when it is wrapped by and mixed with copper powder....

Applicant requests the Examiner’s clarification on how “molten” is the same as “substantially particulated.” In Applicant’s view, “molten” inherently implies a liquid state and “particulated” inherently implies a solid state. Thus, it is the Applicant ‘s position that Liu does not teach each and every recitation of the rejected claims and such claims are in condition for allowance.

### **CLAIM REJECTIONS UNDER 35 U.S.C. § 103**

Claims 20, 21, 23, 25 and 33-38 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Powell (US 6,786,157 B1) in view of Liu (US 200310037692 A1). The Examiner contends that “it would have been obvious to one of ordinary skill in the art at the time that the invention was made to include a metal cap layer disposed upon Powell's liner, thereby providing Powell's particulated stream (jet) with a more dense leading metal portion with enhanced penetrative properties.”

The Examiner further contends that “Powell's shaped charge, as modified by the addition of a metal cap, as taught by Liu, would possess enhanced cutting / penetrative properties for cutting / penetrating well liner pipe either above ground, or when lowered into the well bore while attached to a perforating gun, as is well known in the art.”

Applicant request's the Examiner technical justification for the assertion that increasing the depth of penetration would enhance cutting properties. As the art is understood by the Applicant, penetrating a through wall of a drill pipe is of little concern in the well completion context. However, a wide dispersion blast to ensure that a pipe has been severed throughout a full three-hundred sixty degree arc is of foreseeable concern in order to extract a well tubular. Thus, Applicant re-iterates that one skilled in the art has no motivation to modify Powell with Liu.

To complete the record, Applicant reproduces the arguments previously made: Applicant respectfully submits that the Examiner has used the Applicant's application as a blueprint to combine the contrary teachings of Powell and Liu. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the

claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). MPEP 2143.

In this instance, the prior art clearly does not have a suggestion or motivation to combine. Section 2143.01 of the MPEP defines two cases that preclude a finding of a suggestion to combine: (i) a modification that would change the principle of operation, and (ii) a modification that renders a device unsatisfactory for its intended purpose. For the reasons presented below, the Examiner's proposed modification falls within these two cases.

**1. MPEP 2143.01 VI. *If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)***

The principles of operation of the Powell Device and the Liu Device are distinct and incompatible. Modifying the Powell Device with the metal cap of the Liu Device would clearly change the principle of operation of the Powell Device. The key operational principle of the Powell Device is the dispersion of energy using particulate material:

Accordingly, the present invention provides a hollow charge explosive device including an explosive charge defining boundary walls of a cavity and including particulate material located forward of said boundary walls **so as to be dispersible by said explosive charge when detonated.** (Col. 2, lines 34-38)

The particulate material, if present in a liner, is driven in the same way as that of a conventional shaped charge liner. **However, in this case, the particulate medium forms into a highly energetic non-cohesive stream of particles, generally wider than that produced by a conventionally lined shaped charge.** In this highly energised state, the low bulk density of the liner material and high surface area attributable to each particle of the liner material, together with the larger surface area of the jets cross section, facilitates an intimate and violent kinetically stimulated reaction

with the target medium. Given a knowledge of the intended target material and its constitution, eg a snow slab, the liner material can be chosen to optimise the blast energy yield over and above that normally attributable to the explosive charge alone. (Col. 2, lines 42-55)(emphasis added)

Furthermore, Powell describes the advantages of his invention with respect to the volume of snow removed, not the depth of the crater created by the charge. In particular, Powell explains that significantly greater volume of the craters in Figures 4 and 5 as compared with Figure 3. Powell does not in any way suggest that the depth of penetration would improve the operation of the device. In fact, Figures 6-9 suggest quite the contrary. Powell shows all four embodiments either above or at the surface of the snow. The principle behind the Powell device is based on a wide-dispersion near surface detonation, which is contrary to the deep penetration features of Liu.

The Examiner correctly points out that Powell does suggest a downhole application for its device. However, as Applicant discussed in the prior filing, the downhole application was for “cutting” wellbore tubulars (“rapid internal cutting of narrow bore, thick walled pipes, typical of well liners and drilling shafts”). Given the ample context Powell gives, it is clearly that Powell intends the wide dispersive energy blast to cut the pipe. This is often done to remove pipe from a wellbore and the wide energy blast would be advantageous to sever the pipe. However, the principle of operation of Liu is to generate a concentrated jet driven by sufficient energy to deeply penetrate a formation surrounding a pipe, while forming a small perforation that otherwise leaves the pipe intact. The diametrically opposite principles of operation of these references preclude a finding of prima facie obviousness because the Examiner’s proposed modification or combination of Powell and Liu would necessarily change the principle of operation of Powell, even in downhole applications.

In connection with this issue, Applicant has submitted the affidavit of one skilled in the art in support of the Applicant’s contention that the pipe cutting aspects of Powell have no meaningful relationship with the operation and use of shaped charges.

**2. MPEP 2143.01 (v) *If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)***

The Examiner contends that “enhanced penetrative properties” would motivate one skilled in the art to combine a metal cap layer with the Powell liner for downhole applications. Providing the Powell liner with “enhanced penetrative properties,” however, would make the Powell device unsatisfactory for its stated applications for “cutting of narrow bore, thick walled pipes.” The Examiner has yet to explain how enhancing penetration benefits the cutting of pipes. Enhanced penetration would, as Powell repeatedly explains in various instances, direct the focus of the energy stream away from the area of interest. In this case, the enhanced penetration would direct the energy blast into a formation surrounding the wellbore pipe. In contrast, a wide dispersion shallow blast would impact the perimeter of the pipe to be cut. Thus, cutting pipe requires a severing of a circumference of the pipe, not merely perforating a section of the pipe. Accordingly, one skilled in the art would not combine the metal cap with the Powell liner because the Powell device would be rendered unsatisfactory for its intended purpose of cutting pipe.

#### **Other Discussion in Powell that Teaches Away from the Combination**

Applicant further observes that the applications Powell suggests for the present teaching do not utilize enhanced penetration:

Although the use of present invention has been described in terms of avalanche control applications, the benefits of controlled and highly directional cutting, perforation or stimulation of secondary reactions of explosive devices according to the present invention has a wide range of other potential applications. These include:

rapid generation of **wide access holes** in concrete/rock walls in support of rescue and recovery operations, where a range of liner materials and

particle sizes for the liner can be chosen to control the nature of the cut and/or residual particle penetration into sensitive areas behind;

the use of directing the **highly focused blast effects** to combat and extinguishing burning oil wells;

rapid internal **cutting of narrow bore, thick walled pipes**, typical of well liners and drilling shafts; and

**spalling of loose rock from chamber roofs** in underground mines, civil tunnelling and mining operations and underwater engineering operations. (Col. 8, Lines 13-30)(emphasis added).

“Enhanced penetration” plays no role, to Applicant’s knowledge, in any of the above applications. Rather, each of the above applications involve surface or near surface activity. Applicant further observes that Powell specifically states that his device is for “**cutting**” well liners and drilling shafts—not perforating well liners. Indeed, as one skilled in the art would appreciate, a perforating activities that cuts a well liner is highly undesirable since the overall wellbore structure can be weakened and compromised. In connection with this issue, Applicant has submitted the affidavit of one skilled in the art in support of the Applicant’s contention that the maintaining integrity of a pipe is a design consideration for shaped charges and the lack of integrity may lead to collapse of a wellbore.

### **New Claims**

New Claims 43-46 recite features that for the reasons presented above render these claims allowable.

### **New Affidavit**

Applicant will revise the previously entered Affidavit to reflect the submission as a Rule 132 Affidavit.



### **CONCLUSION**

For all the foregoing reasons, Applicant submits that the application is in a condition for allowance and such action is requested. The Commissioner is authorized to charge any fees deemed necessary or credit any overpayment related to the filing of this Response to Deposit Account No. **13-0010 (COR-1075-US)**.

Respectfully submitted,

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